

FACT SHEET

Harmful Algal Blooms: Background

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KENTUCKY DEPARTMENT FOR ENVIRONMENTAL PROTECTION

What are HABs?

Harmful Algal Blooms (HABs) are excessive growth of cyanobacteria (also known as blue-green algae). Cyanobacteria are microscopic organisms found naturally in surface water that can produce toxins capable of potentially causing illness or irritation in pets, livestock, and humans. Exposure to significant levels of cyanotoxins have even caused death for pets and livestock. The toxins are contained within the cells and are released into the water when the cells die. In addition to producing toxins, cyanobacteria can pose other treatment challenges for public water systems including taste and odor and clogged filters. While called algal blooms, the organisms are actually not algae but photosynthetic bacteria. They may be blue-green in color but can also be other colors such as red or brown depending on the type of cyanobacteria. Blooms of cyanobacteria may resemble streaks of paint on the water. Not all algal blooms, or other aquatic plant growth are considered HABs but they can be a nuisance. It is not possible to tell just by looking at a bloom if they are producing toxins. Over time, these toxins eventually break down and disappear.

What causes HABs and what are the contributing factors?

HABs are caused by a combination of several environmental factors including warmer temperatures, still or standing waters, low water flow and stratification of lakes, abundant nutrients (primarily phosphorus), and sunlight. Due to these factors, HABs are more likely to occur between May and October.

Nutrients that contribute to HABs and other algal blooms (mostly phosphorus and nitrogen) come from many sources, including agriculture, lawn fertilizers, wastewater treatment plants, sewer overflows, and leaking septic systems. Some soils in Kentucky, particularly the Bluegrass region, have naturally high phosphorus due to the limestone geology.

Types of algae and toxins associated with HABs

Microcystis is a widely studied HAB cyanobacteria that produces a toxin called microcystin. Common cyanobacteria in Kentucky include Anabaena, Oscillatoria, Cyndrospermopsis, Planktothrix, Lyngbya and Aphanizomenon. Other toxins that are produced by cyanobacteria are cylindrospermopsin, saxitoxin and anatoxin-a.

What are the effects of HABs

Harmful algal blooms can cause taste and odor problems in drinking water, pollute shorelines with scums, reduce oxygen levels for fish and other animals, cause processing problems for public water supplies, and may generate toxic chemicals. The three main classes of toxins produced by cyanobacteria are: 1) nerve toxins (or **neurotoxins**); 2) liver toxins (or **hepatotoxins**); and 3) skin toxins (or **dermatotoxins**), which may cause itching, rashes, or other allergic reactions. The presence of cyanobacteria does not necessarily mean that toxins are being produced. The level of toxicity depends on the strains present and environmental factors (i.e., the amount of nutrients, light, temperature, stress, etc.). HAB toxicity also depends on the sensitivity, the age, and the sex of the animal or person that consumes or comes into contact with the toxin.

Exposure to humans can occur through direct contact with the water, drinking water that comes from the water body, inhalation of toxins, or consumption of fish or shellfish exposed to the toxins. Effects include neurological impairment, intestinal distress, respiratory distress, skin irritation and severe illness. Exposure to domestic animals and wildlife can cause illness and death.

Sensitive populations

Certain populations may be more sensitive to effects from harmful algal blooms. Small children, elderly, those with weakened or comprised immune systems, pets, and those prone to respiratory allergies and asthma or persons with liver damage or liver disease could be more sensitive when exposed.

Standards

The World Health Organization has established a recreational waters guideline based on moderate probability of adverse health effects. This guideline is based on the potential for short-term adverse effects including skin irritation and gastrointestinal illness. If blue-green algae cell counts are above 100,000 cells/ml, the Division of Water issues a HAB advisory. In addition to cell counts, regulatory requirements or guidelines are being evaluated for drinking water or recreational use of water because of the presence of irritants and toxins associated with HABs. Microcystin, a hepatotoxin produced by *Microcystis* and some other cyanobacteria, is the only HAB toxin for which sufficient information exists to formulate a guideline. Increased monitoring of public drinking water should occur whenever microcystin levels reach 1 ppb (parts per billion, or micrograms/liter, or µg/L). Potential risk to human health from recreational contact is considered low at microcystin concentrations up to 4 ppb and moderate at 20 ppb. Most public water systems and health agencies rely on the World Health Organization's (WHO) guideline of 1.0 ppb for microcystin LR. As there is no federal regulation or established limits, states have set their own: Ohio, Oregon and Oklahoma have a limit of 1 ppb for microcystin-LR, while Florida's is at 10 ppb. Other countries have set standards as well; for example, Australia has proposed a limit of 1.3 ppb for total microcystin and Canada has set the threshold at 1.5 ppb. Six states have developed guidelines for at least one of the other cyanotoxins.

Currently the USEPA does not have any drinking water Maximum Contaminant Levels for algal toxins. However, three (3) toxins are on the Candidate Contaminant List 3 (CCL3): anatoxin-a, microcystin-LR and cylindrospermopsin. EPA is presently developing a Health Advisory document to identify safe levels for drinking water use. EPA has also indicated that these three (3) toxins will be included in the Unregulated Contaminant Monitoring Rule 4, currently scheduled for a 2016 release. In the absence of a regulatory threshold, Kentucky is relying on thresholds used by the World Health Organization and other states to guide its advice to the general public using waters for recreating, and to public water systems, and consumers. The Division of Water has engaged EPA to request their assistance with this emerging problem.

Source Water Protection

The Division of Water is working with a broad group of stakeholders and is committed to develop a statewide Nutrient Reduction Strategy. As part of the Kentucky Nutrient Reduction Strategy and with an eye to the impact of HABs on the water quality of Kentucky's lakes, the Division of Water will be evaluating existing data and acquiring new data to determine potential nutrient water quality criteria for lakes and reservoirs in Kentucky. The Kentucky Nutrient Reduction Strategy will be made available for public comment and should be completed in 2014/15.